Intuitionistic fuzzy sets definition pdf

Intuitionist fuzzy sets are sets whose elements have a degree of membership and not membership. Intuitionist fuzzy sets were introduced by Krasimir Atanassov (1983) as a continuation of the notion of a fuzzy set of Lotfi zade, which in itself expands the classic concept of the set. In classical set theory, membership of elements in a set is rated in binary terms according to a bivalent condition - the element either belongs or does not belong to the set. As an extension, a fuzzy set theory allows for a gradual assessment of the elements' affiliation to the set; this is described using a membership function rated in the real unit interval .0, 1. The fuzzy-sets intuition theory further expands both concepts, allowing you to evaluate items across two functions: for membership and for non-memberships that belong to the real unit interval (0, 1) and whose amount belongs to the same interval as well. Intuitionist fuzzy sets summarize fuzzy sets, as fuzzy set indicators are special cases of membership and non-membership functions, as well as the intuition of fuzzy sets, when there is strict equality: i.e. non-membership function fully complements membership function to 1, leaving no room for any uncertainty. The formal definition Let's have a fixed universe E. Let A be a subset of E. Let's build a set where . We'll call the A-League a fuzzy set (IFS). In publications on ifS, authors mostly deal with the concept of intuition fuzzy set of A. That's why, for the sake of simplicity, large publications, presenting the very definition of the concept often use notation A instead of AP. Mathematically, the more accurate definition of IFS is: but it is also more complex and never used, by 2008. Functions and represent the degree of membership (reality, etc.) and non membership (non-sleep, etc.). Also defined function through , corresponding to the degree of uncertainty (uncertainty, etc.) It is obvious that for each usual fuzzy set : for each and these sets there is a form of IFS Operations Properties, Relationships, Operators For each two intuition fuzzy sets and different relationships and operations have been defined, the most important of which are: Inclusion: , Equality: Classical Denial: Position: Separation: These operations and relationships are defined in the same way. More interesting are the modal operators, which can be determined by the intuition of fuzzy sets. They are unparalleled in fuzzy set theory. Geometric Interpretations Relationships with Other Concepts of ifs Application History IFS See. also Links - Paper Intuitionist Fuzzy Sets, Krassymir T. Atanass, Fuzzy Sets and Systems, North Holland, Volume 20 (1986), 87-96, ISSN 0165-0114 0165-0114 Fuzzy Sets, Krassimir T. Atanassov, Series of Fuzzy and Soft Computing Research, Volume 35, Springer Physica-Verlag, 1999, ISBN 3-7908-1228-5 - 25 years of intuition fuzzy sets, or: Most significant results and errors mine, Krassymir Atanassov, Int. Seminar on IFS and GN, 17 October 2008 (presentation, press publication) This article is a stub. You can help Ifigenia by expanding it. Chapter 38 quotes 1.1k Downloads Page 2 Front Matter Back Matter In early 1983 I came across A. Kaufman's book Introduction to fuzzy set theory (Academic Press, New York, 1975). It was my first introduction to fuzzy set theory. Then I tried to introduce a new component (which determines the degree of non-membership) in identifying these sets and explore the properties of new objects so defined. I identified conventional operations as n, u, me and. over the new sets, but I started to look more seriously at them from April 1983, when I identified operators similar to modal operators need and opportunity. The late George Gargov (April 7, 1947 - November 9, 1996) is the father of the god from the sets I introduced - in fact, he invented the name of the intu Itiist fuzzy, motivated by the fact that the law of the excluded middle does not hold for them. At present, intuitive fuzzy kits are the subject of intensive research by scientists and scientists from more than a dozen countries. This book is the first attempt at a more comprehensive and complete account of the intuitive fuzzy theory of the set and its more relevant applications in various fields. In this sense, it is also of a reference nature. Fuzzi-Logik Fuzziness Fuzzy Setsistic Fuzzy Sets fuzzy logic fuzzy set fuzzy system to better deal with inaccurate and uncertain information in decision-making, the definition of linguistic intuition fuzzy sets (LIFSs) is introduced, which is characterized by a linguistic degree of membership and linguistic degree of non-membership, respectively. To compare any two linguistic intuitive fuzzy values (LIFV), the function of evaluation and accuracy is defined. Then, based on the norm and-conorme, several aggregation operators are invited to aggregate linguistic intuition fuzzy information, which avoids restrictions when leaving the linguistic operation. In addition, the desired properties of these linguistic intuitive aggregation operators are discussed. Finally, a numerical example is given, illustrating the effectiveness of the proposed method in decision-making in multiple groups of attributes (MAGDM).1. The introduction of the Intuitive Fuzzy Set (IFS), which is characterized by a degree of membership and a degree of non-membership, is a very powerful tool for handling vague information. After the groundbreaking study, the IFS attracted a lot of attention from the in various areas and many advances have been made, such as entropy measure IFS (2-7), distance or similarity measurement between IFSs (8-13) and IFS aggregation operators (14-21). In addition, in connection with the IFS, some authors have proposed a number of other tools for processing vague and inaccurate information, according to which two or more sources of vagueness appear simultaneously. Atanass and Gargs introduced the concept of interval-valuable intuitive fuzzy set (IVIFS), which is characterized by the function of membership and the function of non-membership with interval values. Torra and Torra and Narukawa have defined an indecisive fuzzy set (HFS) that can better handle situations where an element can be defined as belonging to multiple values. Chu et al identified a double oscillating fuzzy set in terms of two functions that return two sets of membership values and non-membership values, respectively, to each item in the domain. Although the above fuzzy tools are appropriate for solving problems that are defined as quantitative situations, uncertainty often occurs because of the vagueness of values used by experts in problems whose nature is quite high quality. For example, because of the increasing complexity of the decision-making environment, lack of data or knowledge of the problem area in decision-making in an intuitive fuzzy decision-making environment, the decision-maker may have difficulty expressing the degree of membership and non-membership as exact, while he or she may think that the use of linguistic values is easier and more appropriate to express the degree of membership and non-membership. Like the IFS, linguistic intuitive fuzzy set (LIFS) is characterized by a linguistic degree of membership and a linguistic degree of non-membership, respectively. Using LIFS, decision-makers may consider the degree of linguistic oscillation in an element's affiliation to a set where they cannot easily express their subjective judgment in a single linguistic term. The outlines of the document are as follows. The next section provides a brief introduction to basic knowledge that will be used in the definition of LIFS. Section 3 gives the concept of LIFS and builds the evaluation function and accuracy for LIFS. Section 4 develops several aggregation operators for LIFS. Section 5 offers the MAGDM method with linguistic fuzzy information. Section 6 presents a new approach. Finally, the findings are presented in section 7.2. Preliminary in the following cases summarizes some of the basic concepts and knowledge associated with the IFF and the linguistic approach. Definition 1 (see 1). Let there be a universal set. IFS's is given both where the functions are, stand for the degree of membership and element to, respectively. Anyone meets the condition. called an intuitive index or a degree of uncertainty up. Obviously, if, if, the IFS comes down to a fuzzy set. Some of the main definitions and operations for the IFS are presented as follows. Definition 2 (see No.14, 15). If there are two IFS sets, then (1) if and only if, and ;(2), where is the addition of ;(3);(4);(5);(6);(7), ;(8), . In the real world, many decision-making problems are qualitative aspects that are difficult to quantify. In such cases, it might be more appropriate to treat them as linguistic variables. Let there be a final linguistic term, set with the odd cardinality, where it is a possible linguistic term for a linguistic variable. For example, a set of seven terms can be expressed as follows: you want a set of linguistic terms to satisfy the following characteristics. (1) Set ordered: if and only if. (2) There is a denial operator: such that . (3) Max Operator: if and only if. (4) Min operator: if and only if. To preserve all the information provided, Xu extended the discrete term, set on a continuous linguistic set of terms, where, if, it is called the original linguistic term. Otherwise, it is called a virtual linguistic term. Definition 3 (see No.31, 32). Consider any two linguistic terms, and add and multiply the operations of the linguistic variable are defined as follows: -norm and -conorm were widely used to build operations for fuzzy sets and IFSs.Definition 4 (see No. 33, 34). -Norm is a display satisfying, for all ,1);(2);(3);(4) whenever . The four main ones are the rules, and are as follows: (operation of the lattice); (algebraic surgery); (Operation Lukashevich); (sharp surgery). Definition 5 (see No.33, 34). A-conorm is a display satisfying, for all; ; ; ; When. The four main ones are the conorms, and are as follows: (operation of the lattice); (algebraic surgery); (Operation Lukashevich); (sharp operation).3. Linguistic Intuition fuzzy setThe concept of linguistic intuition fuzzy set (LIFS) is given as follows. Definition 6. Let's be the ultimate universal set and a continuous linguistic set of terms. LIFS in is given as where stand for linguistic membership degree and linguistic element nonmembership to, respectively. For anyone, the condition is always satisfied. called a linguistic degree of uncertain pre. Obviously, if, then LIFS has a minimum degree of linguistic rate, that is, which means that the degree of membership can be accurately expressed by one term and LIFS comes down to a linguistic variable. On the contrary, if, LIFS has the maximum degree of linguistic steminism; That is. Like the IFS, LIFS can be converted into an interval linguistic variable, a variable, indicates that the minimum and maximum language degrees of membership of the elements are and, accordingly. For notary simplicity, we assume both LIFS and contain only one element, which means linguistic intuitive fuzzy values (LIFVs), i.e. pairs and . To compare any two LIFVs, the evaluation function and the accuracy function are defined as follows. Definition 7. Let and be two LIFVs, with . The evaluation function is defined as and the function of accuracy is defined as so, and can be ranked by the following procedure: (1), if, then ;(2), if (a), then ;(b), then ;(c), then . It's easy to see that and that means. Example 8. Let and be LIFVs that are derived from . By applying formulas (5) and (6), we have thus we get .4. Aggregation operators for linguistic intuition fuzzy setsF given the definition of LIFS is given, you need to enter operations and calculations between them. Definition 9. Let there be two LIFVs; then (1), if and only if ;(2), where is the addition of the ;(3) crossing and : ;(4) union and : . Guided by -norm and -conorm, we offer the following laws of operation for linguistic variables. Definition 10. Given any two linguistic terms, the operations of adding and multiplying the linguistic variable are defined as follows: where is -conorm and -norm, respectively. Since, we have, that indicate the results of the operation correspond to the original linguistic set of terms; That is. In addition, it is worth noting that due to monotony -conorm and-norm, the value of function and monotonously increases with increase and , which means the results of work obtained (8) and (9) according to our intuition. If you take the famous in (8) and (9), respectively, they can be rewritten as follows: Example 11. Let me. Application (10), we have, and. So we get and. Such results seem intuitive and can be easily accepted. Also, if we take the laws of Operation Definition 3, we have where the signing is and more than the cardinality of the linguistic set of terms. In addition, if we extend the discrete term, set on a continuous set of terms, where there is a large enough positive integrator, there is an inevitable question of how to define semantics for and . Obviously, or has different semantics in a different linguistic term, set with different cardinal. As a result, it is unrealistic to assign semantics of this linguistic value derived from the linguistic term established with variable cardinality. If we follow the method and for, then we have and. Such results appear to be illogical and cannot be easily accepted. By applying (10), we can overcome the limitations that the signature of a linguistic variable is more than the cardinality of the corresponding set of terms and get to get agrees with our intuition. Based on (10), we can get the following operating laws for LIFVs.Definition 12. Let there be two LIFVs where, with; then some special cases and turn out as follows. If, if, if, if if if, then, theorem 13. Let and be two LIFVs where with . Then, one has (1), (2), (3), (4). Proof. By (11), we have . So based on (13), we do the same, and therefore we get . By (13), we have and; So we get on (14), we get and; so, based on (12), we have since, then, on (14), we have therefore, we get . By (14), we have and; thus, we have, which completes the proof of theorem 13.Motivated on the intuition of fuzzy aggregation operators (14, 15), in the following, we identify some aggregation operators for LIFVs.Definition 14. Let () there be a set of LIFVs. Then, the linguistic intuition of a fuzzy weighted averaging (LIFWA) operator is defined as where the weight vector is (), with and . In particular, if, the operator LIFWA is reduced to the linguistic intuition of fuzzy averaging (LIFA) of the operator; that is, based on definition 14, we get some properties of the LIFWA operator. Theorem 15. Let () there will be a set of LIFVs and a weight vector (), with and ; One has the following. (1) We're going to have a good time. If all are equal, that is, for anyone, then (2)Monotonity. Let () there be a set of LIFVs. If and, for anyone, then for anyone. (3) Borders. Consider the Proof. Since, for anyone, then if, that is, for anyone, then we have a similar way when, for any, we can get . According to definition 7, we get what is, So and, for any, then, based on the monotony of the theorem 15, we get Definition 16. Let () there be a set of LIFVs. Then, the linguistic intuition fuzzy ordered weighted averaging (LIFOWA) operator is defined as where is the th largest and related weight vector, with and . As in Theorem 15, we have some properties of the LIFOWA operator. Theorem 17. Let there be a set of linguistic intuitions of fuzzy values and related weight vector, with and; One has the following. (1) We're going to have a good time. If everyone is equal, that is, for anyone, then (2)Monotonity. Let there be a set of linguistic intuitions of fuzzy values. If and, for anyone, then for anyone. (3) Borders. Consider (4) Switchability. Let there be a set of linguistic intuition fuzzy values, then for anyone where any permutation . Definition 18. Let's set LIFVs. Then, the linguistic intuition of a fuzzy weighted geometric (LIFWG) operator is defined as where the weight vector is, with and. The LIFWG operator has the following properties. Theorem 19. Let's set LIFVs and vector weights, with and; One has the following. (1) We're going to have a good time. If everyone is equal, that is, for anyone, then Let there be a set of linguistic intuitions of fuzzy values. If and, for anyone, then for anyone. (3) Borders. Let's consider the definition of 20. Let's set LIFVs. Then, the linguistic intuition fuzzy ordered weighted geometric (LIFOWG) operator is defined as where is the largest and related vector of weight), with and . As in Theorem 15, we have some properties of the operator LIFOWG. Theorem 21. Let's set LIFVs and the associated weight vector, with and; One has the following. (1) We're going to have a good time. If everyone is equal, that is, for anyone, then (2)Monotonity. Let there be a set of linguistic intuitions of fuzzy values. If and, for anyone, then for anyone. (3) Borders. Consider (4) Switchability. Let there be a set of linguistic intuitions of fuzzy values; then for anyone where any permutation. Lemma 22 (see 37, 38). Let it, and; then with equality, if and only if. Based on Lemma 22, we have the next theorem. Theorem 23. Let's set LIFVs; then one has with equality, if and only if. Proof. Let there be a weight vector, with and; then, Lemma 22, we have, with equality, if and only if; that is, with equality, if and only if; And, with equality, if and only if; that is, with equality, if and only if. Hence, by definition 7, we get, with equality, if and only if and; that is, with equality, if and only if. Similarly, we can also prove with equality, if and only if . In addition to the above properties, we can get the following desired results of operators LIFOWA and LIFOWG. Theorem 24. Let there be a set of LIFVs and the associated weight vector, with and . Then one has the next. (1) If, then (2)If, then (3)If and, for, where is the largest of . Example 25. Let, and be LIFVs that are derived from, and let there be a weight vector. Using (26) and (41), we get aggregated LIFVs as follows: It's easy to see that by definition 7, we calculate the following values of evaluation function and accuracy function. So, then suppose that, which is defined by the usual distribution method based on 39, is a related weight vector. Then, by (36) and (45), we have an easy to see that in the next, we present a processing method for MAGDM problems where vector weight attributes are known and attribute performance values take the form of LIFVs.Let be a set of alternatives and a set of attributes whose weight is vector, with and. Let there be a set of decision makers. Suppose it is a decision matrix where it denotes the value of preference and takes the form of LIFV, which is given by policy makers for an alternative in relation to the attribute and . The proposed method is described as follows. Step 1. Build a linguistic intuitive fuzzy decision-making matrix. Step 2. Use LIFOWA or operator to produce an aggregated decision matrix: where the weight of LIFOWA and LIFOWG is determined by the usual distribution method. Step 3. Aggregate () to give way to the overall overall preference values for each alternative () based on the operator LIFWA or LIFWG. Step 4. Rank alternatives according to definition 7.6. Numerical example In this section we will look at an example adapted from Herrera and Herrera-Veedma. Suppose an investment company that wants to invest the amount of money in the best option. There is a group with four possible alternatives to where to invest: the automotive industry; Is a food company; Is a computer company. arms industry. An investment company must decide on four criteria: risk analysis; Is growth analysis is an analysis of the socio-political impact; is an environmental impact analysis. Weight vector attributes. Three experts are asked to provide their preferences for each alternative for each attribute with a linguistic set of terms. Step 1. Decision-makers provide their assessment values and build a linguistic intuitive fuzzy decision matrix, as shown in tables 1, 2 and 3 respectively. Step 2. Under the usual distribution method (39), the associated weight vector is defined as . Then use the LIFOWA operator to produce the aggregated solution matrix shown in Table 4. In addition, if the LIFOWG operator is used in step 2 instead of the LIFOWA operator, an aggregate solution matrix can be obtained, as shown in table 5.Step 3. Aggregate () to give in to the general preference values for each alternative based on the LIFWA or LIFWG operator with the weight vector as shown in Table 6. RANKINGLIFOWA LIFWA ,gt; LIFOWG LIFWG,'gt; qgt; Step 4. Based on a definition of 7, you can get the alternatives prioritizations listed in Table 6. Obviously, both methods come to the same conclusion that the best alternative. In the above linguistic intuitive fuzzy aggregation operators, the weight of arguments should be clear figures. However, due to the complexity or uncertainty of decision-making, decision makers may have difficulty assigning attributes weights in clear numbers and may be inclined to assign the weight of attributes as linguistic values, interval linguistic values, or LIFV. Existing language aggregation operators cannot deal with such cases. In accordance with the transaction laws described (11) and (12), we can also resolve such decision-making problems. For example, let's say that decision makers accept the weight of attributes as linguistic values in this example, that is,, and that can be converted to LIFVs; There is, and. Thus, by (11) and (12), (12), collective general preference values for each alternative with linguistic weight can be obtained as follows: Without losing generalization, based on table 4, we have the following results: on which we can get a rating of alternatives: that is. Such results do not exceed the cardinality of the relevant linguistic set of terms and can be easily accepted. In contrast, if we convert the above LIFV into interval linguistic values and take the work laws defined by Definition 3, we may have similar problems discussed in example 11.7. Findings In this paper we present the concept of LIFS, which can be considered as a generalization of ifS and is suitable for combating inaccurate and uncertain information in decision-making. Next, we define the evaluation function and the accuracy function for comparing LIFV. In addition, we offer several aggregation operators for LIFS, such as LIFWA operator, LIFOWA operator, LIFWG operator and LIFOWG operator, as well as their desired properties. Compared to existing language laws, we can get more intuitive and acceptable results offered by these aggregation operators. Conflict of interest The Author states that there is no conflict of interest in the publication of this document. 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